

# Technical direction

## Traffic Management

TTD 2017/001

## Operational modelling reporting structure

Summary:	Audience:
<p>This technical direction provides a guideline for practitioners and professional services contractors to follow when submitting an operational traffic model(s) for review by the Traffic Analysis Section of Roads and Maritime Services.</p> <p>The technical direction should be read in conjunction with the 'Traffic Modelling Guidelines' version 1.0 developed by Roads and Maritime and issued in February 2013.</p> <p>The technical direction is a guideline, and should be used as a 'starting point'. Final reports produced for traffic modelling studies might differ from the recommended structure based on the project significance/size.</p>	<ul style="list-style-type: none"> <li>• Roads and Maritime Traffic Modelling and Ancillary Services Panel</li> <li>• Roads and Maritime Services</li> <li>• Any operational traffic modelling project carried out in NSW and required to be endorsed by Roads and Maritime.</li> </ul>

This technical direction is intended to be generic and applicable to the majority of traffic operational modelling projects. As traffic modelling is an evolving sector, it is acknowledged that there may be appropriate variations to the report sections defined in the guideline structure, for example adding or removing sections based on what is applicable to a particular modelling application. A variation to the guideline report structure should be discussed with Roads and Maritime Traffic Analysis Section before commencement.

### Approvals:

<b>Owner:</b>	Majed Marzouk	<b>Review Date:</b>	16 May 2017
<b>Authorised by:</b>	Brett Martin GM(Network & Asset Int.)	<b>Effective Date:</b>	17 May 2017

# Introduction

## Operational model inclusion

For the purpose of this document operational models include the following modelling types:

- Mesoscopic simulation (meso highway assignment)
- Microsimulation models
- Multi-intersection models
- Single intersection models
- Nanoscopic agent-based simulation
- 'Hybrid' models (combination of more than one type of model, often combined mesoscopic and microsimulation models).

## Required reports

It is recommended that the following three (3) reports are provided for modelling studies requiring Roads and Maritime involvement (review and endorsement of models).

A suggested structure for each of the three report types is given at the attachment to this direction.

It should be noted that the size and the format of reports could change or reduce for a relatively small project, for example, and not limited to, submitting a report in a few pages memo format, or combining a methodology report and base model report in a single brief memo report. A change in the size or format of a report should be discussed with the Traffic Analysis Section before commencing.

### 1. Modelling methodology report

The methodology report is required in the early stages of a modelling project. It will assist practitioners and/or professional services contractors and Roads and Maritime to reach an agreement on the processes and assumptions proposed to carry out traffic modelling work. It will also assist in understanding the context of other relevant projects or modelling exercises being developed by Roads and Maritime and which Roads and Maritime will be able to advise on during early stages of the modelling work.

It is recommended that a preliminary draft of this report is discussed and key principles agreed with the Traffic Analysis Section in the project inception meeting to reduce requirements for review and/or modifications to an issued report.

### 2. Base model development report

This report provides a description of the modelling work carried out to develop a base year model with its verification, calibration and validation outcome. It will also include a statement about how well the model(s) will satisfy the objectives of the study brief. Contractors should submit this report to Roads and Maritime when review of a base year calibrated and validated model is required.

It should be noted that contractors should carry out extensive quality and internal audit of base models before issuing this report to Roads and Maritime.

### 3. Option testing report

This should typically be the last report for a traffic modelling project. This report will include a brief description of the works carried out for the future year base case model development as well as a description of option tests and a comparison of model results.

#### Timeframe

This technical direction has effect from June 2017. The guidelines outlined in this direction apply for any operational traffic model that is submitted to Roads and Maritime after the date of this technical direction. A traffic modelling project that has commenced before this technical direction's date could be exempt from following this guideline, subject to approval of the Traffic Analysis Section, however should still follow the recommended guidelines in the Roads and Maritime 'Traffic Modelling Guidelines' version 1.0.

#### Contact person

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#### Report structure

Operational traffic modelling reports submitted to Roads and Maritime in accordance with this direction should at a minimum address the items of the suggested structure of the attachment below.

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Base model development report	7
Option testing report	10

# Modelling methodology report

The acceptable formats for this document are a memorandum or report. The following structure for the modelling methodology report is required as a minimum.

## 1. Introduction

### 1.1 Background

Include a brief description of the project. Additionally, include a brief description of the requirement for initiating traffic modelling analysis.

### 1.2 Project objective

Include an explanation of the overall project objective(s).

### 1.3 Scope of work

Describe the scope of traffic modelling services that the contractor is required to perform.

### 1.4 Stakeholders

List all stakeholders involved, including but not limited to approving authorities, client(s), parties interested in the project (stakeholders), etc.

### 1.5 Report outline

A section outlining a summary list of what is presented in the report.

## 2. Project description

### 2.1 Study area

Include a descriptive and visual representation of the project and the proposed study area. The study area should also include a clear definition of the model's core area.

### 2.2 Land-use

Describe the existing and future year land uses within the study area. Discussion of land-use intensities is not required unless the project's objective includes a requirement to assess the impact of changing land uses. There should be sub-sections to cover both the surrounding and the project land uses separately.

### 2.3 Transport infrastructure

Include a detailed discussion about the existing road and transport network surrounding the project and any proposed future year changes that could potentially affect the existing network. It is understood that due to confidentiality associated with several road projects the proposed future road network might not be available to share at this early stage of the project; thus a schematic/colouring representative would be acceptable.

### 2.4 Assessment years and time periods

Include a brief summary of the years and the proposed time periods that are to be modelled. If a certain model time period is proposed, it is expected that models will be calibrated for each hour within the time period, except for warm-up and cool-down periods.

If modelling is being produced to support economic evaluation of projects, this section should identify how the modelling years meet the purpose of the economic evaluation. To meet requirements for economic evaluation, the first modelled year should be before (or on) the year of opening of the project, and at least one future year, and preferably two, spanning at least 10 years from the first year of modelling, should be developed in order to provide a profile of benefits for economic analysis.

### 3. Input data

#### 3.1 Traffic surveys

This section is one of the most important sections in the methodology report and should include written and graphical description of the proposed traffic survey types, locations, periods, etc.

#### 3.2 Assumptions

Any assumptions proposed by the modellers at this stage should be listed with technical justifications. An assumption could cover the base or the future base models or demand or model parameter settings. Any planned assumptions for modelling future year options should also be included in this section.

#### 3.4 Strategic model

Include a description of demand data that will be sourced from a relevant strategic traffic forecasting model, e.g. cordon files, vehicle types, mode choice, etc.

The section should also identify the strategic model scenario runs that are required for the operational model purposes.

#### 3.5 Traffic signals

Include a brief description of data and data sources for representation of traffic signal operations in the model.

### 4. Methodology

#### 4.1 Base model

- Modelling Platform

Identify the software proposed for the modelling analysis. If the selected software is different to the project brief, then a technical justification is to be presented.

- Traffic demand

Describe the proposed methodology to develop the base year traffic inputs or traffic demand.

- Traffic zones/input

Describe the zone system and any zoning aggregation/disaggregation that is proposed. If a model includes a static assignment route(s) then identify the traffic input locations and any associated assumptions.

- Traffic profile

Explain the methodology planned for profiling the traffic demand over the proposed modelling period.

- Road type

Include a list of the proposed road types for the road network within the model area. It is recommended that a list of proposed values for key parameters for each road type be provided, eg lane capacity, speed, jam capacity, etc.

- Driving behaviour and speed profile

Include all speed profiles that are proposed to be adopted for the model. As Roads and Maritime develops driving behaviour parameters for modelling in NSW then a list of the Roads and Maritime and proposed changes should be included in this section.

- Public transport

Include the process and source that will be used to develop the public transport data.

- Traffic signals

Include a brief description of operational logic, the signal plans, timing settings and linkages and the proposed process to model them.

- Pedestrians and cyclists

Include a description of where and how pedestrians and/or cyclists will be included in a model.

- Assignment type

Briefly include a description of the proposed assignment type to be applied in the model.

#### 4.2 Future model

- Scenario testing

Include a brief description of the future year scenarios/options that the model will be used to assess.

- Future base case assumptions

List any proposed changes to the base year model which will be applied to develop future year models.

- Traffic demand/growth

Describe the methodology proposed to estimate the future year demand(s) associated with each future year scenario.

- Traffic profile

This section is required if there is a proposal to change the existing year traffic profile in the future along with reasons for the proposed changes.

- Public transport

This section is required if there is a proposal to change the existing year public transport routes/plans in the future along with reasons for the proposed changes.

- Traffic signals

This section is required if there is a proposal to change the existing year traffic signal plans in the future along with the reasons for the proposed changes. It is normally expected that modelling applications should optimise traffic signal plans, timing settings and coordination for future year testing in response to changes in traffic demand/patterns.

- Assignment type

This section is required if there is a proposal to change the base model assignment type in the future along with the reasons for the proposed changes.

## 5. Inception meeting outcome

This section should include a brief discussion or minutes of any meeting that has occurred before submitting the report along with a list of the main assumptions agreed for the model.

# Base year model report

The following structure for the 'Base year model report' is required as a minimum.

## 1. Introduction

### 1.1 Background

Include a brief description of the project. Additionally, include a brief description of the requirement for initiating traffic modelling analysis.

### 1.2 Project objective

Include an explanation of the overall project objective(s).

### 1.3 Scope of work

Describe the scope of traffic modelling services that the contractor is required to perform.

### 1.4 Study area

Include a descriptive and visual representation of the project and the proposed study area. This should include a clear description of the model's core area.

### 1.5 Report outline

A section outlining a summary list of what is presented in the report.

## 2. Existing Conditions

### 2.1 Traffic surveys

Include written and graphical description of the traffic survey types, locations, periods, results, etc.

### 2.2 Site visit

Include a description of the site visit(s) activities and the outcome of the visit(s).

### 2.3 Congestion locations

Include a graphical description of the observed/expected congestion locations within the modelled area, which should be based on site visits or traffic survey assessment. Where possible it is recommended that modellers co-ordinate with Roads and Maritime staff regarding knowledge of existing operations and congestion hotspots in the study area.

### 2.4 Existing condition analysis

Provide analysis of the existing study area conditions, as developed through outcomes of Sections 2.1-2.3 that are required to be represented in the base year model(s).

## 3. Model assumptions

### 3.1 Modelling platform

Identify the software to be adopted for the project with the version and release number. If the selected software is different to the project brief, then a technical justification should be presented.

### **3.2 Time period**

Include a brief summary of the years and the proposed time periods that are to be modelled, with justification for selection of model periods. If a certain model time period is proposed, it is expected that models will be calibrated for each hour within the time period, except for warm-up and cool-down periods.

### **3.3 Assignment type**

Describe the assignment type applied in the model.

### **3.4 Vehicle types**

Describe the vehicle types used in the model, along with their dimensions and associated driving behaviour parameters (if any).

### **3.5 Traffic zones/input**

Describe any zoning (or traffic input) aggregation/disaggregation that is implemented for the model and assumptions for this. Include a comparison of the number of zones from strategic and the operational models, if strategic models have been used to source data.

### **3.6 Road types**

List the road types applied in the models for the network within the study area. It is recommended that a list of adopted values for key parameters for each road type be provided, eg lane capacity, speed, jam capacity, etc.

### **3.7 Speed profiles**

Describe all speed profiles that are applied in the model. As Roads and Maritime develops driving behaviour parameters for modelling in NSW, a list of the Roads and Maritime and any proposed changes should be included.

### **3.8 School zones**

Provide a graphical representation of school zone locations along with the updated parameters for these, noting that the speed profile associated with school zones should have been discussed in the previous section.

### **3.9 Traffic signals**

Describe the proposed signal plans, timing and linkages and the process applied to model them.

### **3.10 Public transport**

Describe the process and source used to develop representation of public transport in the model. This should also include description of any other public transport related parameters such as dwell times, etc.

### **3.11 Demand assumptions/adjustment**

Describe assumptions and methodology applied in the demand adjustment or estimation processes used to develop origin-destination demand matrices for the model.

### **3.12 Trip length distribution and through traffic changes**

Include a comparative analysis of the trip length distribution and through trip proportions between the major external zones from any source strategic demand matrices and the operational model. This is required to understand the degree of change in demands arising from any matrix adjustment process.

### **3.13 Pedestrians and cyclists**

Describe assumptions and methodology applied for modelling pedestrians and/or cyclists.



### **3.14 Traffic profile**

Provide a description of the process applied to convert the peak period demand into 15-minute intervals along with profile graphs.

### **3.15 Behaviour parameters**

Include a description of any departures from default driving behaviour parameters and justification for these. As Roads and Maritime develops driving behaviour parameters for modelling in NSW, a list of these and any proposed changes should be included.

### **3.16 General assumptions**

Include a description of any general assumptions adopted in the model development process.

### **3.17 Calibration and validation assumptions/targets**

Describe the calibration and validation target criteria with reference to Roads and Maritime modelling guidelines.

## **4. Model stability**

Provide a statistical analysis of the model's stability in accordance with Roads and Maritime modelling guidelines. This is only required for microsimulation models.

## **5. Model calibration and validation**

Describe the results of base model calibration and validation, including:

1. Convergence
2. Calibration results
3. Travel time validation
4. Congestion hotspot validation
5. Public transport (eg number of buses on main roads)
6. Queue length validation.

## **6. Model limitations**

Include a description of limitations of the model which could affect the future year modelling, along with a detailed technical description of how to account for these limitations in outputs of future year models.

## **7. Conclusion**

Include a summary statement of the fitness for purpose of the base year model.

## **Appendices**

Along with relevant technical appendices, eg count data, relevant correspondence between model developers and Roads and Maritime reviewers should be included in an appendix, as well as any model review comments provided by Roads and Maritime and/or other stakeholders.

Appendices should also include any supporting materials adopted in the base model development process.

# Option testing report

The following structure for the 'Option testing report' is required as a minimum. In general, there might be multiple options modelled as part of a project, and it is recommended that for each option the problem definition, mitigation measures and/or improvement proposed are presented and modelling results are discussed.

## 1. Introduction

### 1.1 Background

Include a brief description of the project. Additionally, include a brief description of the requirement for initiating traffic modelling analysis.

### 1.2 Project objective

Include an explanation of the overall project objective(s).

### 1.3 Scope of work

Describe the scope of traffic modelling services that the contractor is required to perform.

### 1.4 Study area

Include a descriptive and visual representation of the project and the proposed study area. This should include a clear description of the model's core area.

### 1.5 Report outline

A section outlining a summary list of what is presented in the report.

## 2. Option testing

Describe the options/scenarios being modelled as part of the project. Where possible include graphical representations for ease of reference.

## 3. Assumption list

Describe all assumptions adopted as part of the process of assessing future year scenario(s). The assumptions should be discussed and agreed by the RMS Project Manager in co-ordination with the Traffic Analysis Section.

Furthermore, any assumed trip generation rates should be documented in this section.

## 4. Future year demand

Provide a description of the methodology adopted to estimate the future year traffic demands. Include summary tables documenting a comparative assessment of future year demand against the base year demand (by vehicle type and for each year/option).

## 5. Base model operational results

Summarise traffic analysis results generated from the base year model(s) at both the network wide and local levels (where possible).

## **6. Future base case operational results**

Describe traffic analysis results generated from the future year base case ('do minimum' or 'business as usual') models at both the network wide and local levels (where possible).

## **7. Option operational results**

Describe traffic analysis results generated from all future year option models at both the network wide and local levels (where possible).

Additionally, if an option requires enhancement/mitigation measures, then describe traffic analysis results generated from mitigated option and compare it to the option without improvements.

## **8. Operational assessment comparison**

Provide a technical description comparing the results described in the previous three chapters.

## **9. Conclusion and recommendation**

Provide conclusions and outcomes based on the modelling results.